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CHRONIC ENERGY DEFICIENCY IN WOMEN FROM RURAL BANGLADESH: SOME SOCIOECONOMIC DETERMINANTS

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Summary. This paper explores a number of socioeconomic factors thought to explain the wide prevalence of undernutrition among rural Bangladeshi women. The 1992 baseline survey data of the BRAC–ICDDR,B Joint Research Project at Matlab were used. Anthropometry was performed on a random sub-sample of 1462 currently married, non-pregnant women between 15 and 49 years of age. Women's nutritional status was defined in terms of Body Mass Index (BMI = wt in kg/ht in m^2). Compared with women from better-off households, the mean weight (41·2 vs 43·0 kg; $p < 0{\cdot}0001$), mid-upper arm circumference (MUAC) (22·1 vs 22·7; $p < 0{\cdot}0001$), and BMI (18·5 vs 19·1; $p < 0{\cdot}0001$) of poor women were consistently lower. However, no significant difference in mean height was found between the two groups. The results showed that women aged more than 35 years are twice as likely to have a BMI $< 18{\cdot}5$ compared with younger women. Both years of schooling received and socioeconomic status are found to be important predictors of women's BMI. Women who have received one or more years of formal education are nearly half as likely to suffer chronic energy deficiency (BMI $< 18{\cdot}5$) than women with no schooling. Again, better-off women are found to be 0·77 times less likely to have chronic energy deficiency than women from poor households. The implications of these findings in improving the nutritional status of rural Bangladeshi women are discussed.

Introduction

The high prevalence of undernutrition in Bangladesh is popularly attributed to a combination of extreme poverty, environmental insult and poor health. Women are particularly vulnerable, suffering from social, economic and nutritional deprivation to a far greater extent than men (Mcguire & Popkin, 1990; Amin, 1995). Indeed, evidence suggests that discrimination against the girl child begins well before birth and continues

through infancy, childhood and adolescence, such that adult women enter their reproductive years having already experienced considerable nutritional stress (WHO, 1980; Chen, Huq & D'Souza, 1981; Ware, 1981; Rizvi, 1983). The energy costs of reproduction further exacerbate an already fragile state of energy balance with deleterious consequences for both women and their offspring (Merchant, Martorell & Haas, 1990). The association between severe undernutrition, and the risk of bearing low birth weight babies (who are correspondingly at greater risk to mortality) is well-established and of particular policy concern (Allen *et al.*, 1994; Naidu & Rao, 1994).

While there are limited prospective data that investigate the mortality and morbidity risk of low BMI in the developing world, increasing evidence suggests that individuals with low BMI (Body Mass Index = wt in kg/ht in m^2) suffer greater illness, impaired work capacity, reduced social activity and lower income (Shetty & James, 1994). For example, a recent study of an urban slum population in Bangladesh revealed a significant inverse association between BMI and work-disabling morbidity. Among adult men with a BMI of 16 or below, 55% had lost one or more working days in the month prior to interview. This proportion dropped to 35% among those with a BMI between 16 and 17 (Pryer, 1993). It should be noted, however, that the direction of causality between BMI and illness is difficult to ascertain. Just as low BMI may increase the risk of morbidity, chronic illness is frequently the cause of low BMI. Using instrumental variable estimation procedures to mitigate possible covariance between low BMI and illness, a recent four-country study found that high morbidity predisposes individuals to low BMI in Pakistan and Kenya. No such relationships were found in the Philippines or Ghana (Garcia & Kennedy, 1994).

The same multi-country study described above detects a positive association between BMI and the amount of time devoted to work (Kennedy & Garcia, 1994). Based on a review of the few experimental studies that investigate the impact of low BMI on work capacity, Durnin also concludes that the ability of persons with a BMI of 17 or less to perform high intensity or load bearing activities may be seriously impaired (Durnin, 1994).

This paper documents the extent of undernutrition among rural Bangladeshi women of childbearing age, and explores a number of socioeconomic factors thought to explain its genesis and distribution. For the purposes of analysis, we employ BMI as a simple and reliable measure of adult nutritional status. We apply cutoff points for BMI used to diagnose and classify Chronic Energy Deficiency (CED), a state of low or varying nutritional status known to compromise health and function. According to this classification scheme, a BMI between 17 and 18·4 denotes mild CED, a BMI in the range of 16 to 16·9 is considered moderate CED, and a BMI less than 16 indicates a state of severe energy deficiency that is incompatible with normal health and function (Ferro-Luzzi *et al.*, 1992).

Household's eligibility (see later) to join a targeted credit programme is used as a proxy indicator of socioeconomic status. This classification is necessary in order to document the extent of differentials between the eligible and non-eligible groups before the initiation of development activities. This would facilitate an assessment of the impact of relevant credit-based development programmes on the nutritional status of women from beneficiary households at some later stage of the project.

Methods

This paper draws on data from the 1992 Matlab Baseline Survey undertaken in the first phase of the BRAC–ICDDR,B Joint Research Project (Ahmed *et al.*, 1994). Founded in 1972, BRAC is a large, indigenous, non-governmental organization involved in rural poverty alleviation. BRAC's integrated Rural Development Programme (RDP) targets the poorest of the poor with special emphasis on improving the health and socioeconomic conditions of rural women and children. In 1992, BRAC extended RDP activities, including micro-credit and non-formal education, to 100 villages of Matlab thana where the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B) has been operating a Demographic Surveillance System (DSS) since the early 1960s. Following the introduction of RDP in Matlab, a research collaboration between BRAC and ICDDR,B was established to examine prospectively the relationship between socioeconomic development and the health and well-being of the rural poor. As a first step, a baseline survey of 11,343 households was carried out in a sample of BRAC and non-BRAC villages in ICDDR,B's demographic surveillance system area. Socioeconomic information was collected on the entire household sample using a set of pre-tested structured questionnaires that were administered by trained female interviewers. Anthropometry was performed on a sub-sample of 1462 currently married, non-pregnant women between the age of 15 and 49 years who were selected randomly from the surveyed households. Weight was measured in kilograms using bathroom scales that were calibrated daily and zeroed before each reading. Height was measured in centimetres using a locally made wooden measuring board with a metal measurement tape attached. All measurements were made according to standard WHO procedures (Jelliffe, 1966). Women's nutritional status was defined in terms of body mass index (BMI).

For the purposes of this paper, a combination of bivariate and multivariate statistics is used to explore the socioeconomic determinants of women's nutritional status. In this analysis, households in the baseline survey are classified into two groups according to whether or not they meet eligibility criteria for participation in BRAC's Rural Development Programme (RDP): that the household possesses less than 0·5 acres of land excluding the homestead, and that a member of the household participates in manual labour for at least 100 days a year. These households rank among the poorest of the poor. Households that are not eligible for BRAC's RDP are comparatively better-off socioeconomically, and include rural elite as well. In subsequent analyses, therefore, household eligibility for BRAC's RDP is used as a proxy indicator of socioeconomic status. Eligible households are hereafter referred to as the 'poor socioeconomic group', while non-eligible households represent the 'better-off'.

Initial analyses involve bivariate comparisons of the nutritional status of women from these two socioeconomic groups. Following this, the independent effects of socioeconomic and demographic factors on women's nutritional status are estimated using logistic regression. The dependent variable in this model is the presence or absence of chronic energy deficiency as indicated by a BMI under 18·5. Independent variables include age, years of schooling, total living children, socioeconomic status as indicated by eligibility for BRAC's RDP, and number of times married. Results are expressed as odds ratios.

Table 1. Characteristics of study women by socioeconomic status

	Poor[A] ($n=819$)	Better off[B] ($n=546$)	All ($n=1365$)	t test [A] vs [B]
Weight (kg)	41·3±5·0	43·0±5·4	41·9±5·2	−5·89**
Height (cm)	149·1±5·3	149·7±5·2	149·3±5·3	−1·92
MUAC (cm)	22·1±1·8	22·7±2·0	22·3±1·9	−5·67**
BMI	18·5±1·8	19·1±2·0	18·8±1·9	−5·81**
Age (years)	32·3±7·8	32·7±8·5	32·5±8·1	−1·07
Years of schooling	1·2±0·5	1·7±0·8	1·4±0·7	−14·51**
Total living children	2·5±1·5	2·7±1·6	2·6±1·6	−2·34*

*$p<0·05$; **$p<0·0001$.

Table 2. BMI of study women by age group and socioeconomic status

Age (years)	Poor[A]		Better off[B]	
	Mean±SD	n	Mean±SD	n
15–24[C]	18·9±1·8	133	19·5±2·0	105
25–34[D]	18·6±1·7	390	19·3±1·8	225
35+[E]	18·3±1·9	296	18·8±2·1	216

[A] vs [B]: t=−1·07; [C] vs [D]: t=2·11 ($p<0·05$); [D] vs [E]: t=2·70 ($p<0·05$); [E] vs [C]: t=−3·81 ($p<0·001$).

Results

Compared with women from better-off households, the nutritional indicators of poor women are consistently lower with the exception of height: mean weight (41·2 vs 43·0 kg; $p<0·0001$), mid-upper arm circumference (MUAC) (22·1 vs 22·7; $p<0·0001$) and BMI (18·5 vs 19·1; $p<0·0001$) (Table 1). As the heights are similar, it indicates that the background and early nutritional influence in both groups were similar. Women from poorer households also are significantly less educated than women from better-off households, receiving on average 1·2 years of schooling compared with 1·7 years among the wealthier group. While women from both socioeconomic groups are of similar age, poorer women appear to have fewer surviving children than their counterparts from better-off households ($p<0·05$).

The BMI of the two groups of women stratified by age is shown in Table 2. With increasing age, a significant deterioration in mean levels of BMI is detected among women from both socioeconomic groups. This age-related trend is even more apparent when the prevalence of CED is presented by age group and socioeconomic status. As shown in Table 3, the proportion of women with severe (BMI<16·0) and moderate

Table 3. Prevalence of chronic energy deficiency (BMI < 18·5) among study women by socioeconomic status

Age (years)	Poor				Better off			
	<16·0	16·0–16·9	17·0–18·4	All (*n*)	<16·0	16·0–16·9	17·0–18·4	All (*n*)
15–24	3·8	9·0	30·1	133	4·8	4·8	23·8	105
25–34	5·1	13·3	28·7	390	1·8	5·3	27·1	225
35+	9·8	16·2	32·8	296	5·1	16·7	26·4	216
All ages	6·2	12·8	30·5	819	3·7	8·7	25·7	546
χ^2 significance:		$p<0·001$				$p<0·0001$		

Table 4. Characteristics of sample women by socioeconomic status and CED

	Poor		Better off		All		
	<18·5	18·5+	<18·5	18·5+	<18·5	18·5+	*n*
Religion							
Muslim	51·0	49·0	39·1	60·9	46·1	53·9	1243
Hindu	47·2	52·8	46·9	53·1	47·1	52·9	122
χ^2 significance	NS		NS		NS		
Years of schooling							
None	52·8	47·2	47·6	52·4	51·2	48·8	923
1–5	42·1	57·9	35·9	64·1	38·7	61·3	313
5+	42·1	57·9	25·9	74·1	28·0	72·0	132
χ^2 significance	$p<0·05$		$p<0·05$		$p<0·05$		
Total living children							
≤2	47·3	52·7	35·7	64·3	42·7	57·3	485
3–4	51·6	48·4	43·6	56·4	48·5	51·5	493
5+	53·9	46·1	39·3	60·7	47·4	52·6	390
χ^2 significance	NS		NS		NS		
No. times married							
Once	49·6	50·4	39·2	60·8	45·2	54·8	1268
More than once	62·3	38·7	48·0	52·0	58·0	42·0	100
χ^2 significance	NS		NS		$p<0·05$		

(BMI 16·0 and 16·9) CED increases progressively, irrespective of socioeconomic status. It remains, however, that 67% more women suffer from severe CED in poorer households than in better-off households. For moderate CED, levels among poorer women exceed those among better-off women by 47%.

The socio-demographic characteristics of the two groups of women according to their nutritional status are shown in Table 4. Neither religious affiliation, total number of living children nor involvement in income earning have a significant impact on

Table 5. Logistic regression of factors predicting women's CED

	Odds ratio	*p* value
Age (years)		
15–24	1·00	—
25–34	1·11	0·561
35+	2·08	0·000
Years of schooling		
None	1·00	—
1–5	0·66	0·002
5+	0·48	0·000
Total living children		
≤2	1·00	—
3–4	0·96	0·786
5+	0·75	0·124
Socioeconomic status		
Poor	1·00	—
Better off	0·77	0·030
No. times married		
Once	1·00	—
More than once	1·41	0·115

expected proportions of women suffering from mild CED (BMI < 18·5), as indicated by chi-squared values. Significant findings are evident when considering the nutritional status of women in relation to years of schooling received. In both socioeconomic groups, a greater than expected proportion of women with no schooling had BMIs under 18·5. Conversely, a far greater proportion of women with schooling had BMIs greater than 18·5 in both groups. A significant overall association between the number of times a women has been married and nutritional status is also observed; a larger than expected proportion of widowed, divorced or abandoned women who had remarried suffer mild CED. Specifically, among women who had been married more than once, 58% have BMIs under 18·5 compared with 45% of women who have been married only once. Small numbers probably explain the lack of significance when women from poorer or better-off groups are analysed alone.

Table 5 shows the results of logistic regression analysis using the presence or absence of chronic energy deficiency (BMI < 18·5) as the dependent variable. As expected based on bivariate findings, age, years of schooling and socioeconomic status emerge as significant variables that predict the dependent variable.

Discussion

As both bivariate and multivariate analyses suggest, the nutritional status of women in rural Bangladesh is the complex outcome of many intersecting social, economic and demographic factors. However, compared with results from a similar population of

women studied in the Matlab surveillance area almost one decade earlier (Bhuiya & Mostafa, 1993), data from this survey suggest that the nutritional status of women has improved slightly over time. Contrasting survey data from 1983 and 1992, secular increases in weight (40·1 vs 41·9 kg), height (148·1 vs 149·3 cm) and BMI (18·3 vs 18·8) are apparent. However, persistent socioeconomic differentials point to the continued influence of poverty on nutritional status.

The second result of note is the significant deterioration of women's nutritional status with increasing age in both socioeconomic groups such that women aged 35+ years are twice as likely to have a BMI $<18{\cdot}5$ compared with younger women. One explanation for this age-related trend is the hypothesis of maternal depletion, whereby frequent repreoductive cycling is thought to lead to a deterioration in health and nutritional status over the lifecycle. If this hypothesis is correct, one might expect that low BMI would also be associated with increasing parity. Two previous studies in Bangladesh have found a significant inverse relationship between age, parity and standardized maternal weight in the Matlab surveillance area (Chowdhury, 1987; Miller, Rodriquez & Pebley, 1992). However, in the present study, both bivariate and multivariate analyses fail to detect a significant association between total numbers of living children and CED in either socioeconomic group. This finding corroborates findings by Prentice *et al.* (1981) and a multi-country study by the World Health Organization in which no relationship between maternal nutritional status and parity was detected in eight of nine countries considered (Omran & Standley, 1981). As Winkvist *et al.* suggest (Winkvist, Rasmussen & Habicht, 1992), it may be that parity is not an accurate indicator of reproductive stress as it does not take into account miscarriages, abortions or stillbirths, nor does it capture the stressful effects of short birth intervals or overlapping lactation and pregnancy. Indeed, if one supposes that severely energy deficient women are unlikely to successfully bear many children, high parity women may in fact represent the healthiest and best-nourished (Miller & Huss-Ashmore, 1989; Winikoff & Castle, 1988). Alternatively, the association between age and nutritional status may represent the cumulative impact of gender inequalities in intra-household food distribution over the life-cycle (Chen *et al.*, 1981; DasGupta, 1987; Katona-Apte, 1975; Anwar & Kishwar, 1984; Lewis, 1975).

The third result of note is the identification of both years of schooling received and socioeconomic status as important predictors of BMI. As results from logistic regression indicate, women who have received one or more years of formal education are nearly half as likely to suffer chronic energy deficiency than women with no schooling (Table 5). While empirical measurement of the pathways linking female education and improved health and nutritional outcomes is the object of specific study in the BRAC–ICDDR,B project, at this point it is hypothesized that – beyond the provision of health and nutrition information – female education confers important life skills of benefit to the health and well-being of women and their offspring. Female education is thought to facilitate the development of women's autonomy, confidence and perceived self-efficacy, thereby strengthening their ability to take timely and appropriate action to prevent or solve health problems instrumentally (Schwarzer, 1992). The capacity of educated women to acquire and apply knowledge, and to understand the context, language and organization of health care services, is also believed to enhance their ability successfully to harness health resources, and to comply with treatment (Levine, LeVine & Richman, 1991).

Socioeconomic status is also identified by logistic regression as a factor influencing the probability of chronic energy deficiency. Specifically, better-off women are found to be 0·77 times less likely to have CED than women from poorer households. Data also suggest a link between women's education and the socioeconomic status of the households to which they belong: better-off women having on average 1·7 years of education, compared with 1·2 years among the poorer group. Not only do resource-poor households have difficulty supporting the costs of educating female children in terms of school fees, lost labour and delayed marriage, rarely are they able to accumulate sufficient dowry to marry uneducated daughters into well-off households.

Results from this study indicate that chronic energy deficiency among women of childbearing age is a pervasive and multidimensional problem of a magnitude that demands explicit policy attention. Reaching a prevalence of almost 50% among women from poor households, undernutrition is of particular concern when increased energy requirements associated with pregnancy and lactation go unmet. Acute energy deficiency superimposed on a chronically energy deficient state poses serious risk to the health and survival of both women and their offspring. For example, a preliminary study by Shetty and James (1994) shows a progressive reduction in birth weight of babies with increasing CED. Among mothers with grade one or mild CED, 36% of babies born are below the 2·5 kg cut-off point for low birth weight. This proportion increases to 41 and 53% among mothers with moderate and severe CED, respectively. However, health and nutrition policies and programmes that specifically target women of childbearing age are insufficient in themselves. Concomitant efforts to promote the education and health of the girl child, and to address the root causes of poverty and patriarchy that perpetuate female undernutrition are needed. In this respect, integrated rural development programmes such as RDP, with its emphasis on the economic empowerment of poor women, and the education of girl children, are of critical importance.

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